



Nature Notes

Petrified Power: Zion's Chinle Formation

When hiking beneath the canyon walls of Zion, our eyes are easily drawn to the immense scale of the rock around us. The magnitude of the landscape can be impressive and yet, more often than not, the rocks may appear static and unchanging. They are, of course, still mobile: erosion continues to pull rocks from the heights into the bottom of the canyon, but seeing a big rockfall is not necessarily a regular or a predictable occurrence. Yet if we explore the history of the rocks' creation, we find ourselves standing amidst remnants of the earth's volatile forces—powerful events such as floods and volcanic eruptions which laid down the materials of the cliff walls we see today. Past time shows us that the formation of the rocks was anything but tame.

Perhaps one of the most dramatic rock layers in Zion National Park, in terms of the forces behind its creation, is the Chinle Formation, best seen in the southern and lowest-elevation portions of the park. The Chinle is sandwiched within the bottom half of Zion's rock strata, and is comprised of 400-500 feet of sediments which were laid down 225-210 million years ago. This band of rock began to form at a time when Zion's world was tremendously different from the prevailing environment. Instead of being an arid desert, the area was riddled with water. Huge river systems, perhaps on the scale of portions of the Amazon River today, dominated the land. These waterways carried into this region a mixture of sediments ranging from course-grained sandstones to pebbles to mudstones.

Abundant water allowed a large variety of plants and animals to thrive here, and large trees were perhaps one of the more notable



The Chinle Formation is visually captivating due to its rich array of banded colors. NPS Photo/Sally Wier

life-forms. Primitive conifers of the *Araucarioxylon* and *Woodworthia* species flourished. The larger *Araucarioxylon* likely stood 200 feet high, with a trunk around two to six feet wide. Though they lived over 200 million years ago, we are lucky enough to encounter remnants of these giants in Zion. Portions of the trees, sometimes entire trunks, have been preserved as fossils of petrified wood—a physical proof of the ancient past. Petrified wood may seem lifeless and static to our eyes, but the processes which preserved the wood as fossils were quite dramatic.

As these trees thrived in their wet environment, volcanic eruptions to the south and west of Zion spewed ash into the air. Large quantities of cinders rained down on the trees, likely killing many of them. Subsequent floods washed through the large river systems, uprooted the dead trees, and

washed them into huge logjams along the flood plains. Over time, more eruptions occurred and ash continued to cover the piles of jumbled logs. The quick burial of the logjams by the ash had the effect of smothering the wood. All oxygen was

Rocks sit silently, yet their formation was influenced by by powerful and volatile forces.

removed from the immediate area around the trees, inhibiting natural decomposition. Over time, the overlying ash decomposed and freed silica molecules which mineralized in microscopic voids in the buried wood.

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What's Blooming in Zion?

Whorled Milkweed (*Asclepias subverticillata*-Asclepiadaceae Family) has clusters of delicate, white flowers and long, narrow leaves that exude a sticky, milky-white sap when punctured. Spend time watching this flower along the Pa'rus Trail: it is busy with pollinators. Monarchs and queen butterflies, bumblebees and pollen wasps gather its nectar. Orange and black milkweed bugs feed on the plant's tissue and seeds. The bugs concentrate the bad-tasting compounds of milkweed sap in their bodies, using them to repel their predators.

Wild Gourd (*Cucurbita foetidissima*-Cucurbitaceae Family) produces an attractive green and white fruit following pollination of its large, golden flowers. The fruit can be cooked like squash when it is young, but it becomes too bitter for eating as it matures. The mature fruit has been used for decorative purposes and in making musical instruments, especially rattles.

Sacred Datura (*Datura wrightii*-Solanaceae Family) is highly visible with its large, white, trumpet-shaped flowers tinged with purple. Although the flower is both fragrant and alluring, it is also toxic. All parts of the plant contain alkaloids that can cause hallucinations, seizures, and even death. Even contact with its leaves or pollen can cause problems for some people. Photograph but don't touch. Look for it throughout Zion Canyon.

Remember, it is against park policy to pick flowers. Please heed signs that say, "Stick to the Trail," and give plants a chance.



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On August 1, 1929, the first issue of *Nature Notes* was published. Written and produced by Education Departments at Zion and Bryce Canyon, its purpose was to provide information to "those interested in educational opportunities, the natural history, the scientific features or the scenic beauties of this region." Eighty-two years later, *Nature Notes* continues this tradition by covering subjects pertinent to Zion National Park and its employees.

Zion's Misunderstood Rodents

The visitor pointed to my photograph of the hand with the nasty bite and stitches. "What did that?" he asked.

"A rock squirrel," I replied, pointing to a photograph of a chubby-looking rodent with bright brown eyes.

"I've seen a lot of them on this trail," the visitor continued.

"That's why we show these photos as part of the River Rendezvous program," I explained. "Some people feed and even try to pet the rock squirrels here, and we want them to know that's dangerous. It's not good for the rock squirrels, either."

I had set up my photographs on a bench about three-quarters of the way up the one-mile Riverside Walk. It faced a sandy alcove tucked back against towering cliffs of Navajo Sandstone. Behind the bench, the Virgin River tumbled, sounding unusually loud as it echoed between narrowing canyon walls.

For the next hour and a half, I would be answering visitor questions and talking about the plants and wildlife they might encounter. One of the most commonly observed animals along the trail is the rock squirrel (*Spermophilus variegatus*).

The Riverside Walk offers ideal rock squirrel habitat. They prefer rocky locations including cliffs, canyon walls, and boulder piles. They dig burrows and raise their babies under large rocks, and they use rocks as lookout points. Classified as ground squirrels, they can climb trees almost as well as tree squirrels, and will forage and seek shelter high on limbs and branches as well as on the ground.

Less than fifteen minutes into my program, I noticed a rock squirrel digging in the sand next to my bench. With its sharp front claws it unearthed a round, dark object, then suddenly leaped to one edge of the bench. There it sat, rapidly twirling the object in its paws while gnawing.

Visitors were now gathering to watch and photograph the squirrel. Apparently quite unalarmed by the attention it was getting as it ate, it seemed to exemplify the words visitors frequently use to describe it: "Cute. Tame. Friendly."

Although rock squirrels may be cute, they are anything but tame and friendly. Their apparent friendliness is actually a lack of fear of humans and a desire to secure food. Their sharp, chisel-like incisors are capable of slicing through barriers—including human skin—in a matter of seconds and are well-adapted for their incredibly varied natural diet which includes vegetation, flowers, acorns, pinyon pine nuts, cactus and cactus fruit, berries, and roots and tubers. Rock squirrels also eat invertebrates such as beetles and grasshoppers. They will hunt and kill small rodents and birds, even young wild turkeys, and eat carrion.

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Against one predator, the western diamondback rattlesnake, rock squirrels have developed a formidable defense. In a behavior that is called "mobbing," the squirrel will lunge forward repeatedly and wave its tail from side to side, kicking sand and rocks at the snake's head. It will even bite the snake if it gets the opportunity. If a squirrel gets bitten, it may not be affected. Adult rock squirrels have evolved the capacity to at least partially neutralize the venom.

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Rock squirrels use large boulders as lookout points. Their loud chucks and whistles warn of nearby danger. NPS Photo/Amy Gaiennie

The Western Pipestrelle: A Camper's Friend

Dusk is upon the South Campground. The sunlight fades on the Watchman. Tired campers settle in as campfire smoke and laughter rise up. A human mother begins her nightly ritual. She is feeding and preparing her children for sleep. They will slumber safely under the hazy light of the Milky Way.

Near the Virgin River, another family begins its nightly ritual. A mother bat crawls out of her rocky, crevice home. She has given birth to twins, but the babies will stay in the roost while she hunts. (Twins are no surprise to her; they are the rule. The Western pipestrelle bat almost always has two.)

The mother takes flight, never straying too far from the Virgin River. She needs to be near water because she has a very high metabolism and has to drink often. Before she begins her hunt, she will sip water from a calm section of the river. A turbulent spot could wash her away.

Western pipestrelles are the first bat species to appear before dusk, eating diurnal insects including wasps and bees, a delicious appe-



The Western pipestrelle is the first bat species to appear at dusk in Zion National Park. NPS Photo

tizer. The main course comes as darkness shrouds Zion Canyon. She will forage most of the night because, as a lactating mother, she will need to eat 40% of her body weight.

Her flight is erratic and fluttery. She uses her whole body to capture a wide variety of small insects: caddis flies, stone flies, moths, beetles, and mosquitoes. At times she scoops moths with her thin wings. Other times she applies a fatal bite to a beetle's back. Her flight style gives her the appearance of a clumsy predator, but she is a skilled huntress. Pipestrelles, along with other bat species, are

among the greatest consumers of nocturnal insects, and a camper's good friend because they devour many stinging and biting pests.

It is now early morning in Zion Canyon. The last few stars disappear from the sky. Canyon winds have blown away the last traces of campfire smoke. Mother bat—tired and full—enters the rocky crevice by the river where she will sleep and nurse her awaiting pups. She prefers to care for her young away from a colony, but may return to one once they are grown.

Mom bat settles into her rocky home just after dawn. The camper's children return to the river's edge after sunrise and a good breakfast. The children are unaware of the presence and proximity of the bat family. Mother bat sleeps soundly. Her pups are nestled by her side. They grow quickly and will fly within one month. That evening, mother bat awakens for another nighttime foray. The human mother would be delighted to know thousands of biting insects will be removed from the river where her children play. *-Amanda DeGroat*

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Even more remarkably, recent research indicates that rock squirrels may apply snake scent to their bodies to camouflage their own scent. This may be especially important in the young, who have not yet developed resistance to the snake's deadly bite.

It is easy for us to misunderstand the rock squirrel as we stroll along the Riverside Walk, glimpsing only a brief moment in its daily drama of survival. The often harsh realities of life in Zion forces it to forage, hunt, raise babies, and defend itself and them from enemies—in a struggle often far removed from human view. We can help by respecting—and not interfering—with its skills and status as a wild creature.

-Amy Gaiennie

"In nature, nothing is perfect and everything is perfect."

Alice Walker

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As the wood structure was slowly replaced by these minerals, logs transformed into stone—fossils of petrified wood.

On a hot day in mid-summer, hiking along the Chinle Trail does not seem to have any connection to wide, wet river systems. A scorching sun evaporates any exposed water in the blink of an eye. Yet if we chance to stumble upon a piece of petrified wood, or simply take a moment to wonder at the bands of Zion's rock formations, we can meditate on prehistoric time and marvel at the potency of transformations in the land. The rocks sit silently, yet they give us subtle clues that the world which produced them was churning, flooding, erupting, and creating. Today the walls of Zion stand strong, but they endured great turmoil to manifest themselves in the striking forms we now see.

- Sally Wier

Petrified wood may seem static, but the formation of the fossils was quite dramatic.



A log of petrified wood found in Zion's Chinle Formation was once a thriving conifer over 200 million years ago. NPS Photo/Sally Wier